Development of the Laser-Induced Incandescence Method for the Reliable Characterization of Particulate Emissions

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ABSTRACT

A laser-induced incandescence (LII) system has been developed for the non-intrusive and real-time measurement of soot particulate concentration and primary particle size, Fig.1. The LII system incorporates an innovative two-color pyrometry technique for accurate measurement of soot concentration. Furthermore, the LII signal decay characteristics are used to infer the primary particle size. Besides the self-calibrating feature, the instrument also uses low laser fluence and a top-hat laser beam for improved accuracy in the measurement. The system automatically maintains constant laser fluence over a wide range of environmental conditions and also attenuates the collected incandescence signal as needed to handle a large range of soot concentration. Another key feature of the instrument is its remote operation capability when it is connected to any computer network such as the Internet. This paper discusses the measurement technique, the instrumentation, and the experimental results obtained from a variety of applications including diesel and direct injection spark ignition automobile emission studies, and carbon black formation process in an industrial furnace.

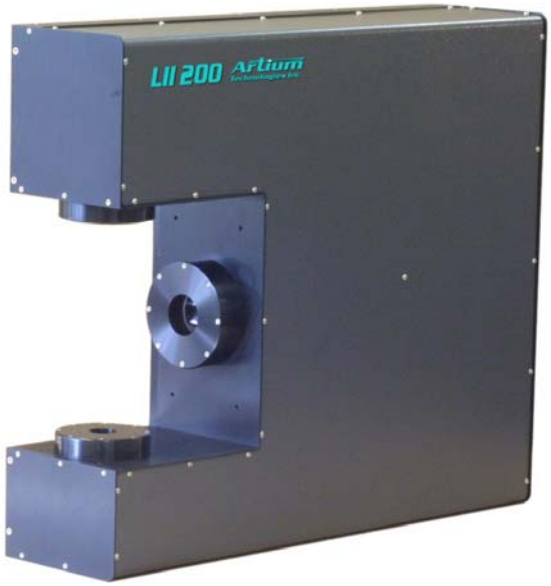

Figure 1: Photograph of the Artium LII system.